

# PATENT COOPERATION TREATY

## PCT



### INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

REC'D 10 SEP 2004

Applicant's or agent's file reference WO 35463	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/IB 02/03834	International filing date (day/month/year) 18.09.2002	Priority date (day/month/year) 18.09.2002
International Patent Classification (IPC) or both national classification and IPC F01D17/16		
Applicant HONEYWELL INTERNATIONAL INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.  
  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
  
 These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:
  - ☒ Basis of the opinion
  - ☐ Priority
  - ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - ☐ Lack of unity of invention
  - ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - ☐ Certain documents cited
  - ☐ Certain defects in the international application
  - ☐ Certain observations on the international application

Date of submission of the demand  10.03.2004	Date of completion of this report  13.09.2004
Name and mailing address of the International preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Angelucci, S  Telephone No. +31 70 340-4330  

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**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-7 as originally filed

**Claims, Numbers**

1-8 received on 30.06.2004 with letter of 30.06.2004

**Drawings, Sheets**

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-5,8
	No: Claims	6,7
Inventive step (IS)	Yes: Claims	1-5,8
	No: Claims	6,7
Industrial applicability (IA)	Yes: Claims	1-8
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following document:

D1: US-A-2 976 013 (ULRICH HUNTER DAVID) 21 March 1961 (1961-03-21)

2. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document):

a variable nozzle device for a turbocharger comprising:

an annular nozzle (20, 21, 22) formed between an inner wall and an outer wall (40), and

an annular arrangement of adjustable vanes (22) interposed in the nozzle for defining a plurality of nozzle passages, wherein the nozzle (20, 21, 22) is adjustable by controllably adjusting the vanes and by varying an axial clearance between the outer wall and the vanes, wherein the axial movement of the outer wall to the vanes is limited by a spacer (see col. 2, line 69 - col. 3, line 7 of the description) which defines a minimum axial clearance between the vanes and the outer wall.

- 2.1 The subject-matter of claim 1 differs from this known variable nozzle device in that

the nozzle is adjustable by **controllably** varying an axial clearance between the outer wall and the vanes.

The variable nozzle device of D1 shows an active control in adjusting the vanes. Furthermore the variable nozzle device of D1 shows an adjustable axial clearance which is passively regulated by the working fluid differential pressure between the nozzle and the inlet volute, forcing the outer wall against the adjacent surfaces of the nozzle blades for sealing purposes.

- 2.2 The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

3. The problem to be solved by the present invention may be regarded as improving the turbine performance in a **controlled** fashion enlarging the gas flow area both pivoting the vanes and adjusting the axial clearance **separately or simultaneously**.

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3. The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

In D1 the outer wall is not controllably adjusted therefore it is not possible to improve the turbine performance in a controlled fashion enlarging the gas flow area both pivoting the vanes and adjusting the axial clearance separately or simultaneously. The outer wall in D1 is adjusted for sealing purposes only.

4. Claims 2-5 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
5. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 6 and 7 is not new in the sense of Article 33(2) PCT.

The document D1 discloses (the references in parentheses applying to this document):

a method for operating a variable nozzle device for a turbocharger comprising a plurality of vanes arranged in a nozzle (20, 21, 22) defined between an inner wall and an outer wall (40), the vanes forming nozzle passages with all the method steps as in claim 6 of the present a application.

The step of varying an axial clearance between the outer wall and the vanes by axially moving the outer wall to and from the vanes is indeed shown in D1, being the outer wall moved by the working fluid differential pressure between the nozzle and the inlet volute.

- 5.1 If the applicant would have used the wording "**controllably** varying an axial clearance..", as used in claim 1, the method claim 6 would have been considered new and inventive (see §2 - §3 of the present communication).
6. Dependent claim 7 do not contain any features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of novelty and inventive step, see document D1.
7. Nevertheless if the combination of the features present in independent claim 6

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and dependent claim 8 would have been used, it would have been neither known from, nor rendered obvious by, the available prior art.

- 7.1 Claim 8 states that the step of increasing or decreasing the axial clearance and pivoting the vanes can be performed independently and or simultaneously thus showing the variation of the axial clearance in a controlled fashion.

Enclosure of June 30, 2004

PCT-Application No.: PCT/IB02/03834  
Applicant: HONEYWELL INTERNATIONAL INC.  
Our ref: WO 35463

**Claims 1 to 8**

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1. A variable nozzle device (1) for a turbocharger comprising:

an annular nozzle (3) formed between an inner wall (11) and an outer wall (10), and

an annular arrangement of adjustable vanes (4) interposed in the nozzle (3) for defining a plurality of nozzle passages,

wherein the nozzle (3) is adjustable by controllably adjusting the vanes (4) and by controllably varying an axial clearance between the outer wall (10) and the vanes (4),

**characterized in that**

the axial movement of the outer wall (10) to the vanes (4) is limited by a spacer which defines a minimum axial clearance between the vanes (4) and the outer wall (10).

2. A variable nozzle device (1) according to claim 1, wherein the outer wall (10) is axially moved to and from the vanes (4) by an actuator, preferably a pneumatic actuator (6).

3. A variable nozzle device (1) according to claim 1 or 2, wherein the outer wall (10) is defined by a hollow shaft (5) which comprises an axial slit forming a bypass for exhaust gas which does not pass through the nozzle (3).

4. A variable nozzle device (1) according to any one of claims 1 to 3,

comprising means for operating the axial movement of the outer wall (10) in such a manner that the outer wall (10) is moved away from the vanes (4) as an operational rotational speed of the turbocharger increases.

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5. A variable nozzle device (1) according to any one of claims 1 to 4,  
comprising means for operating the axial movement of the outer wall (10) in such a manner that the outer wall (10)  
10 is moved to the vanes (4) as an operational rotational speed of the turbocharger decreases.

6. A method for operating a variable nozzle device (1) for a turbocharger comprising a plurality of vanes (4) arranged  
15 in a nozzle (3) defined between an inner wall (11) and an outer wall (10), the vanes (4) forming nozzle passages, the method comprising the steps of:

adjusting the nozzle passages by controllably  
adjusting the vanes (4), and

20 varying an axial clearance between the outer wall (10) and the vanes (4) by axially moving the outer wall (10) to and from the vanes (4), and

limiting the axial movement of the outer wall (10) to the vanes (4) by a spacer which defines a minimum axial  
25 clearance between the vanes (4) and the outer wall (10).

7. A method for operating a variable nozzle device (1) for a turbocharger according to claim 6,  
**characterized by the following steps:**

30 increasing the axial clearance between the outer wall (10) and the vanes (4) as the operational rotational speed of the turbocharger increases; and

decreasing the axial clearance between the outer wall (10) and the vanes (4) as an operational rotational speed  
35 of the turbocharger decreases.



8. A method for operating a variable nozzle device (1) for a turbocharger according to claim 6 or 7, wherein

5 the step of increasing the axial clearance between the outer wall (10) and the vanes (4) starts and/or stops either independently from or simultaneously with a step of pivoting the vanes (4) for enlarging the gas flow area of the annular nozzle (3); and/or

10 the step of decreasing the axial clearance between the outer wall (10) and the vanes (4) starts and/or stops either independently from or simultaneously with a step of pivoting the vanes (4) for reducing the gas flow area of the annular nozzle (3).